

WHAT IS CLAIMED IS:

1. A two-dimensional image detecting device, which has a pixel substrate being provided with a pixel alignment layer including a plurality of pixels, and an opposing substrate being provided with a photoconductive layer for generating electrical charge in response to incident light, comprising:

conductive connecting members which are disposed so as to correspond to the pixels on said pixel alignment layer and which electrically connect said pixel alignment layer and said photoconductive layer, and

space keeping members for keeping a space between the substrates.

2. The two-dimensional image detecting device as defined in claim 1, wherein said space keeping members are disposed in a lattice form so as to surround said conductive connecting members.

3. The two-dimensional image detecting device as defined in claim 1, wherein said space keeping member has electrical insulation.

4. The two-dimensional image detecting device as defined in claim 1, wherein said space keeping member has

higher hardness than said conductive connecting member.

5. The two-dimensional image detecting device as defined in claim 1, wherein said space keeping member is made of a resin material having photosensitivity.

6. The two-dimensional image detecting device as defined in claim 1, wherein said space keeping member is formed by mixing a reinforcing member or a filler, which has electrical insulation, into a resin material having electrical insulation.

7. The two-dimensional image detecting device as defined in claim 1, wherein each of said conductive connecting member and said space keeping member has a height between  $5\mu\text{m}$  and  $30\mu\text{m}$ .

8. The two-dimensional image detecting device as defined in claim 1, wherein said conductive connecting member is made of a material which is softened so as to have adhesion.

9. The two-dimensional image detecting device as defined in claim 8, wherein said space keeping member has a softening temperature which is higher than said conductive

connecting member.

10. The two-dimensional image detecting device as defined in claim 1, wherein said space keeping member is made of a polyimide polymeric material having photosensitivity.

11. The two-dimensional image detecting device as defined in claim 1, wherein said space keeping member is made of an epoxy, acrylic, or urethane polymeric material.

12. The two-dimensional image detecting device as defined in claim 1, wherein said space keeping member is made of  $\text{SiO}_2$ .

13. The two-dimensional image detecting device as defined in claim 1, wherein said conductive connecting member is made of a thermosetting or photo-curing adhesive.

14. The two-dimensional image detecting device as defined in claim 1, wherein said photoconductive layer is has a polycrystal film made of a material selected from the group consisting of CdTe and CdZnTe.

15. The two-dimensional image detecting device as

defined in claim 1, wherein said photoconductive layer exhibits photoconductivity to a radiation, a visible light, and an infrared radiation.

16. The two-dimensional image detecting device as defined in claim 1, wherein a plurality of said pixels are disposed in a lattice form on said pixel substrate, each of said pixels includes a storage capacitor for accumulating electrical charge generated from said photoconductive layer, and a switching element for taking out electrical charge accumulated in said storage capacitor and said switching element is connected to an electrode wire for outputting electrical charge to outside.

17. The two-dimensional image detecting device as defined in claim 16, wherein said switching element is a TFT element.

18. A two-dimensional image detecting device comprising:

an active-matrix substrate being provided with a pixel alignment layer including electrode wires arranged in a lattice form, a plurality of switching elements respectively disposed at intersections of said lattice form, and pixel electrodes connected with said electrode wires via said

switching elements, and

an opposing substrate including electrode sections formed so as to oppose virtually an entire surface of said pixel alignment layer, and a semiconductive layer with photoconductivity formed between said pixel alignment layer and said electrode sections,

wherein said substrates are disposed such that said pixel alignment layer of said active-matrix substrate and said semiconductive layer of said opposing substrate oppose each other, said substrates are connected to each other via conductive connecting members, which are formed by patterning in accordance with said pixel electrodes, with conductivity and adhesion, and space keeping members are formed by patterning so as to keep a space between said substrates.

19. The two-dimensional image detecting device as defined in claim 18, wherein said space keeping members are made into a lattice form so as to surround said conductive connecting members.

20. The two-dimensional image detecting device as defined in claim 18, wherein said space keeping member is made of a material having electrical insulation.

21. The two-dimensional image detecting device as defined in claim 18, wherein said space keeping member has higher hardness than said conductive connecting member under a thermocompression bonding condition in a connecting step for said conductive connecting members.

22. The two-dimensional image detecting device as defined in claim 18, wherein said space keeping member is made of a resin material having photosensitivity.

23. The two-dimensional image detecting device as defined in claim 18, wherein said space keeping member is obtained by mixing a reinforcing member or a filler, which has electrical insulation, into a resin material having electrical insulation.

24. A manufacturing method for a two-dimensional image detecting device, said device comprising a pixel substrate being provided with a pixel alignment layer having a plurality of pixels, and an opposing substrate being provided with a photoconductive layer for generating electrical charge in response to incident light, said method comprising the steps of:

a connecting member forming step for forming conductive connecting members on one of said substrates in accordance

with the pixels of said pixel alignment layer,

a keeping member forming step for forming space keeping members, which keep a space between said substrates, on one of said substrates, and

a connecting step for bonding said substrates such that said pixel alignment layer and said photoconductive layer oppose each other.

25. The manufacturing method for the two-dimensional image detecting device as defined in claim 24, wherein an insulating material is adopted for said space keeping member.

26. The manufacturing method for the two-dimensional image detecting device as defined in claim 25, wherein in said connecting member forming step, said conductive connecting members are formed on one of said substrates, and

in said keeping member forming step, said space keeping members are formed on the other substrate.

27. The manufacturing method for the two-dimensional image detecting device as defined in claim 25, wherein in said connecting member forming step, a photosensitive resin layer with conductivity is formed on said substrate, and then, the layer is exposed and developed so as to form a

pattern of said conductive connecting members.

28. The manufacturing method for the two-dimensional image detecting device as defined in claim 25, wherein in said connecting member forming step, a conductive resin is electrodeposited onto said substrate so as to form a pattern of said conductive connecting members.

29. The manufacturing method for the two-dimensional image detecting device as defined in claim 25, wherein in said connecting member forming step, a conductive adhesive is printed onto said substrate so as to form a pattern of said conductive connecting members.

30. The manufacturing method for the two-dimensional image detecting device as defined in claim 29, wherein said conductive adhesive is printed in accordance with an ink jet method.

31. The manufacturing method for the two-dimensional image detecting device as defined in claim 29, wherein said conductive adhesive is printed in accordance with a screen printing.

32. The manufacturing method for the two-dimensional



image detecting device as defined in claim 31, wherein said screen printing is performed by using an Ni metal mask.

33. The manufacturing method for the two-dimensional image detecting device as defined in claim 32, wherein regarding said screen printing, an epoxy adhesive paste having an Ag conductive particle is used as a material for said conductive connecting member.

34. The manufacturing method for the two-dimensional image detecting device as defined in claim 25, wherein in said keeping member forming step, an insulating photosensitive resin layer is formed on said substrate, and the layer is exposed and developed so as to form a pattern of said space keeping members.

35. The manufacturing method for the two-dimensional image detecting device as defined in claim 25, wherein in said keeping member forming step, an insulating layer made of an insulating material is formed on said substrate, a photosensitive photoresist is formed thereon, and then, the layers are subjected to exposing, developing and etching operations so as to form a pattern of said space keeping members.

36. The manufacturing method for the two-dimensional image detecting device as defined in claim 25, wherein in said keeping member forming step, an insulating paste is printed on said substrate so as to form a pattern of said space keeping members.

37. The manufacturing method for the two-dimensional image detecting device as defined in claim 36, wherein said insulating paste is printed in accordance with an ink jet method.

38. The manufacturing method for the two-dimensional image detecting device as defined in claim 36, wherein said insulating paste is printed in accordance with a screen printing.

39. The manufacturing method for the two-dimensional image detecting device as defined in claim 25, wherein in said keeping member connecting step and said connecting member forming step, when said space keeping member and said conductive connecting member respectively have heights of H1 and H2, said space keeping members and said conductive connecting members are formed so as to satisfy  $H1 \leq H2$ .

40. The manufacturing method for the two-dimensional

image detecting device as defined in claim 39, wherein in said keeping member connecting step and said connecting member forming step, said space keeping members and said conductive connecting members are formed such that  $H1$  and  $H2$  satisfy  $2 \times H1 \geq H2 \geq H1$ .

41. The manufacturing method for the two-dimensional image detecting device as defined in claim 39, wherein in said connecting step, said conductive connecting members are softened by a thermocompression bonding and are pressed and deformed between said substrates.

42. The manufacturing method for the two-dimensional image detecting device as defined in claim 41, wherein a material, which exhibits higher hardness than said conductive connecting member in said thermocompression bonding, is used as a material for said space keeping member.

43. The manufacturing method for the two-dimensional image detecting device as defined in claim 25, wherein in said connecting member forming step, said conductive connecting members are independently formed into island shapes on said pixels, and

in said keeping member forming step, said space keeping

members are formed so as to surround each of the pixels.

44. The manufacturing method for the two-dimensional image detecting device as defined in claim 43, wherein said connecting step is performed under a reduced pressure condition.

45. The manufacturing method for the two-dimensional image detecting device as defined in claim 43, wherein in said keeping member forming step, said space keeping members are disposed at a circumference of said substrates as well.

46. The manufacturing method for the two-dimensional image detecting device as defined in claim 25, wherein a thermosetting or photo-curing adhesive is used as a material for said conductive connecting member.

47. The manufacturing method for the two-dimensional image detecting device as defined in claim 25, wherein a material, which is softened so as to have adhesion, is used as a material for said conductive connecting member.

48. The manufacturing method for the two-dimensional image detecting device as defined in claim 47, wherein a material, which has a higher softening temperature than said

conductive connecting member, is used as a material for said space keeping member.

49. The manufacturing method for the two-dimensional image detecting device as defined in claim 25, wherein a photosensitive polyimide polymeric material is used as a material for said space keeping member.

50. The manufacturing method for the two-dimensional image detecting device as defined in claim 25, wherein an epoxy, acrylic, or urethane polymeric material is used as a material for said space keeping member.

51. The manufacturing method for the two-dimensional image detecting device as defined in claim 21, wherein  $\text{SiO}_2$  is used as a material for said space keeping member.

52. The manufacturing method for the two-dimensional image detecting device as defined in claim 25, wherein a material having adhesion and a bonding property is used as a material for said space keeping member.

53. The manufacturing method for the two-dimensional image detecting device as defined in claim 25, wherein a material, which is obtained by mixing either a reinforcing

member or a filler into a resin material, is used as a material for said space keeping member.

54. The manufacturing method for the two-dimensional image detecting device as defined in claim 53, wherein a glass, ceramic, or plastic material is used as a material for said reinforcing member and said filler.

55. The manufacturing method for the two-dimensional image detecting device as defined in claim 25, wherein in said connecting member forming step and said keeping member forming step, said conductive connecting members and said space keeping members are formed on one of said substrates.

56. The manufacturing method for the two-dimensional image detecting device as defined in claim 55, wherein steps performed later in said connecting member forming step and said keeping member forming step include:

a bonding step in which a bonding sheet, which is constituted by a photosensitive resin layer and a thermoplastic resin layer, is bonded onto said substrate while performing a heating operation, the photosensitive resin layer being disposed lower, and

a photolithography step in which the bonding sheet is exposed and developed so as to form a pattern of said

conductive connecting members or said space keeping members.

57. The manufacturing method for the two-dimensional image detecting device as defined in claim 55, wherein in said connecting member forming step and said keeping member forming step, said conductive connecting members and said space keeping members are formed on said pixel substrate.

58. The manufacturing method for the two-dimensional image detecting device as defined in claim 55, wherein in said connecting member forming step and said keeping member forming step, the lower of said conductive connecting members and said space keeping members are firstly formed.

59. A manufacturing method of a two-dimensional image detecting device, said two-dimensional image detecting device comprising:

an active-matrix substrate including a pixel alignment layer having electrode wires aligned in a lattice form, a plurality of switching elements respectively disposed at intersections of said lattice form, and pixel electrodes connected with said electrode wires via said switching elements, and

an opposing substrate including electrode sections formed so as to oppose virtually an entire surface of said

pixel alignment layer, and a semiconductive layer with photoconductivity formed between said pixel alignment layer and said electrode sections, said method comprising the steps of:

a first step for forming a pattern of conductive connecting members, which have conductivity and adhesion, in accordance with said pixel electrodes on one of said substrates,

a second step for forming a pattern of said space keeping members, which have electrical insulation and keep a space between said substrates, so as to surround said conductive connecting members in a lattice form on the other substrate,

a third step for arranging said substrates such that said pixel alignment layer of said active-matrix substrate and said semiconductive layer of said opposing substrate oppose each other, and

a fourth step for connecting and bonding said substrates via said conductive connecting members.

60. The manufacturing method for the two-dimensional image detecting device as defined in claim 59, wherein either said conductive connecting members or said space keeping members are formed by patterning in a bonding step and a photolithography step of a photosensitive resin sheet.



61. The manufacturing method for the two-dimensional image detecting device as defined in claim 59, wherein said conductive connecting members and said space keeping members are formed into patterns such that said conductive connecting members are higher than said space keeping members before bonding said active-matrix substrate and said opposing substrate.

62. A manufacturing method of a two-dimensional image detecting device, said two-dimensional image detecting device comprising:

an active-matrix substrate including a pixel alignment layer having electrode wires aligned in a lattice form, a plurality of switching elements respectively disposed at intersections, and pixel electrodes connected with said electrode wires via said switching elements, and

an opposing substrate including electrode sections formed so as to oppose virtually an entire surface of said pixel alignment layer, and a semiconductive layer with photoconductivity formed between said pixel alignment layer and said electrode sections, said method comprising the steps of:

a first step for forming a pattern of space keeping members which have electrical insulation and keep a space between said substrates, and a pattern of conductive

connecting members, which have conductivity and adhesion, in accordance with said pixel electrodes on either said active-matrix substrate or said opposing substrate,

a second step for arranging said substrates such that said pixel alignment layer of said active-matrix substrate and said semiconductive layer of said opposing substrate oppose each other, and

a third step for bonding said substrates via said conductive connecting members.

63. The manufacturing method for the two-dimensional image detecting device as defined in claim 62, wherein either said conductive connecting members or said space keeping members are formed by patterning in a bonding step and a photolithography step of a photosensitive resin sheet.

64. The manufacturing method for the two-dimensional image detecting device as defined in claim 62, wherein said conductive connecting members and said space keeping members are formed into patterns such that said conductive connecting members are higher than said space keeping members before bonding said active-matrix substrate and said opposing substrate.